WHAT IS CLAIMED IS:

1. A method of determining the concentrations of a plurality of constituent components of unaltered whole blood, including:

generating a plurality of substantially monochromatic radiation wavelengths, each wavelength of an absorbance subset of said plurality of wavelengths having been selected by their ability to distinguish the constituent components and having been selected to minimize the effects of radiation scattering and to maximize radiation absorbance by said constituent components, and each wavelength of a scattering subset of said plurality of wavelengths having been selected to maximize the effects of radiation scattering by unaltered whole blood relative to the effects of radiation absorbance by unaltered whole blood;

irradiating a sample of unaltered whole blood with said plurality of radiation wavelengths, through a depth of said sample chosen to minimize radiation scattering by unaltered whole undiluted blood;

detecting intensities of said radiation wavelengths, after passing through said depth of said sample, at a distance from said sample, and over a detecting area, both chosen to minimize the effects of radiation scattering by unaltered whole blood on the determination of concentration of said constituent components; and

calculating concentrations of said plurality of constituent components of said sample of unaltered whole blood, based upon detected intensities of each of said plurality of radiation wavelengths, and based upon predetermined molar extinction coefficients for each of said constituent components at each of said radiation wavelengths of said absorbance subset.

2. The method of claim 1, wherein said depth of said sample is in the range of 80 to 150 micrometers.

3. The method of claim 2, wherein said depth of said sample is approximately 90 micrometers.

4. The method of claim 1, wherein said detecting area is at least approximately 150 square millimeters.

5. The method of claim 4, wherein said detecting area is at least approximately 600 square millimeters.

6. The method of claim 1, wherein said distance from said sample is within the range of 0 to 10 millimeters.

7. The method of claim 6, wherein said distance from said sample is approximately 1 millimeter.

8. The method of claim 1, wherein said step of detecting is performed over a half-aperture angle of radiation emanating from said sample of at least approximately 30 degrees.

9. The method of claim 8, wherein said step of detecting is performed over a half-aperture angle of radiation emanating from said sample of at least approximately 70 degrees.

10. The method of claim 1, further comprising:

correcting said calculated concentrations of constituent components for the effects of finite spectral bandwidth of the substantially monochromatic wavelengths on the extinction coefficients of each constituent component.

11. The method of claim 1, said plurality of constituent components including HbO_2, HbCO, Hi and Hb, said method further comprising:

before said generating step, selecting four radiation wavelengths by computing an error index for each of HbO_2, HbCO and Hi as the sum of the absolute values of the errors that are induced in the measurement of relative concentrations of HbO_2, HbCO and Hi due to a change in optical density measurements; and

selecting a quadruple of radiation wavelengths having minimum error indices.

12. The method of claim 11, said quadruple of radiation wavelengths each being within the range of 510 to 630 nanometers.

13. The method of claim 12, said quadruple of radiation wavelengths comprising 522, 562, 584 and 600 nanometers.

14. The method of claim 12, said quadruple of radiation wavelengths comprising 518, 562, 580 and 590 nanometers.

15. The method of claim 12, said quadruple of radiation wavelengths comprising 520.1, 562.4, 585.2 and 597.5 nanometers.

16. The method of claim 12, said constituent components further including bilirubin, said method further comprising:

before said generating step, selecting a radiation wavelength within the range of 475 to 500 nanometers as the radiation wavelength for the measurement of bilirubin.

17. The method of claim 16, said radiation wavelength for the measurement of bilirubin being 488.4 nanometers.

18. The method of claim 12, said constituent components further including sulfhemoglobin, said method further comprising:

before said generating step, selecting a radiation wavelength within the range of 615 to 625 nanometers as the radiation wavelength for the measurement of sulfhemoglobin.

19. The method of claim 18, said radiation wavelength for the measurement of sulfhemoglobin being 621.7 nanometers.

20. The method of claim 1, further comprising:

correcting said calculated concentrations of constituent components for the effects of light scattering by red blood cells.

21. The method of claim 20, said correcting step comprising, correcting said calculated concentrations of constituent components as a function of the relative concentrations of the constituent components.

22. The method of claim 21, said correcting step further comprising:

iteratively determining a red blood cell scattering vector for the particular composition of the whole blood sample being analyzed; and

using said red blood cell scattering vector to correct said calculated constituent component concentrations.

23. The method of claim 1, further comprising:

correcting said calculated constituent component concentrations for the effects of non-specific light scattering.

24. The method of claim 23, said correcting step comprising, correcting said calculated concentrations of constituent components as a function of the relative concentrations of the constituent components under consideration.

25. The method of claim 24, said correcting step further comprising:

iteratively determining a non-specific scattering vector for the particular composition of the whole blood sample being analyzed; and

using said non-specific scattering vector to correct said calculated constituent component concentrations.

26. The method of claim 1, further comprising, correcting said calculated concentrations of constituent components for the effects of light scattering by red blood cells and for the effects of non-specific light scattering.

27. The method of claim 26, said correcting step comprising, correcting said calculated concentrations of constituent components as a function of the relative concentrations of the constituent components under consideration.

28. The method of claim 27, said correcting step further comprising:

iteratively determining a red blood cell scattering vector for the particular composition of the whole blood sample being analyzed;

iteratively determining a non-specific scattering vector for the particular composition of the whole blood sample being analyzed; and

using said non-specific scattering vector and said red blood cell scattering vector to correct said calculated constituent component concentrations.

29. The method of claim 28, said plurality of constituent components including HbO_2, HbCO, Hi and Hb, said method further comprising:

before said generating step, selecting four radiation wavelengths by computing an error index for each of HbO_2, HbCO and Hi as the sum of the absolute values of the errors that are induced in the measurement of relative concentrations of HbO_2, HbCO and Hi due to a change in optical density measurements; and

selecting a quadruple of radiation wavelengths having minimum error indices.

30. The method of claim 29, said quadruple of radiation wavelengths each being within the range of 510 to 630 nanometers.

31. The method of claim 30, said constituent components further including bilirubin, said method further comprising:

before said generating step, selecting a radiation wavelength within the range of 475 to 500 nanometers as the radiation wavelength for the measurement of bilirubin.

32. The method of claim 31, said constituent components further including sulfhemoglobin, said method further comprising:

before said generating step, selecting a radiation wavelength within the range of 615 to 625 nanometers as the radiation wavelength for the measurement of sulfhemoglobin.

33. The method of claim 32, further comprising, before said generating step, selecting a radiation wavelength within the range of 635 to 645 nanometers as an additional radiation wavelength for the measurement of sulfhemoglobin.

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